**Diffedge**

Differentiation, sensitivity analysis and identification of hybrid Models

Diffedge calculates the symbolic derivative of the mathematical models described in the form of block diagram under Simulink.

- **Optimisation problem illustrating the Diffedge methodology**

  We want to optimise the guess parameters $k, k_1, k_2$. The model includes a discontinuity (saturated integrator) and a strong nonlinear function in the loop. The model output is $y_{out}$ and the objective function is $y_{cost}$.

  **Diffedge syntax**

  ```matlab
  Diffedge('derivative','mymdl', {'k','k1','k2'})
  ```

  The obtained symbolic derivative is also represented in graphic form (block diagrams) and can be used like any Simulink model. We remain in the Simulink environment.

- **Diffedge and analytic sensitivity analysis**

  We want to know the behaviour of the model output with respect to tuning parameters $k, k_1, \tau$.

- **Fields cover by Diffedge**

  - Analytic sensitivity and statistical analysis,
  - Optimisation and identification,
  - Fault detection for system monitoring,
  - Diagnostic and optimisation in real-time,
  - Optimal, nonlinear, adaptive control,
  - ...

- **Capabilities**

  - Diffedge is already used in the industry. It computes a derivative model (600 blocks) with respect to 18 parameters in less than 3 minutes.

- **Legend**

  - **Diffedge : Automatic Tasks**

- **Contacts**

  **Appedge**
  18-22 rue d’Arras
  92000 Nanterre (France)
  Web : http://www.appedge.com
  Phone : (33) 01 47 82 95 05
  E-mail: diffedge@appedge.com

- **Examples of blocks processed with Diffedge**

- **User benefits**

  - No additional programming is required and modification of the model.
  - Diffedge is an automatic tool for optimisation problems and parametric sensitivity analysis.
  - Diffedge is an useful tool for capitalizing on information and for understanding the behaviour of the model.
  - Diffedge allows to apply several kinds of optimisation algorithms with constraints which necessitate to provide the gradient.
  - ...

  **Diffedge reduces product cost and facilitates innovation**

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